Oil and Gas, which is the Belle of the Ball ? The Impact of Oil and Gas Reserves on Sovereign Risk

Emma Hooper

amse
école d'économie d'aix-marseille
aix-marseille school of economics

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Emma Hooper †

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Abstract:

Using panel data from emerging oil and gas exporting countries, this paper investigates whether oil and gas reserves have a significant impact on sovereign spreads. The main findings are that oil and gas reserves affect differently financial markets. Indeed, oil reserves increase spreads, contrary to gas reserves that lower them. The evidence shows that financial markets' reaction depends also on institutional quality. When interactions with institutional variables are introduced, financial markets give more importance to political stability and corruption for oil reserves than gas reserves.

JEL Classification Numbers: G15, H63, Q32

Key words: Exhaustible natural resources, sovereign risk, spreads, emerging markets

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†Aix-Marseille University (Aix-Marseille School of Economics), CNRS, & EHESS, 2 rue de la Charite, 13002 Marseille, France. Email: emma.hooper@univ-amu.fr

1 Introduction

Many oil countries use their oil reserves in order to borrow on international financial markets. Oil is usually seen by credit rating agencies as a good collateral, as they view it as a liquid asset and its stock is more or less known. This practice, called asset-backed securitization of future-flow receivables, flourished after the Mexican crisis in 1994-95, especially in Latin Americas countries such as Mexico, Brazil, Argentina, Venezuela. For Ketkar and Ratha (2001), "Nearly one-half of the dollar amounts raised via future flow transactions are backed by oil and gas export receivables." Nevertheless, this financial method has some drawbacks. For example, the presence of proven oil reserves gave Nigeria a credit-rating far higher than its macroeconomic fundamentals would have otherwise justified, and the country had to struggle with a huge debt for years. For most of emerging oil economies, which are usually not very diversified, the current deep drop of oil prices represents a dramatic fall of oil revenues. Therefore, the issue of debt overhang can become even more critical, and the risk of a sovereign default could be looming. It could be the case of Venezuela, which is currently strangled by its debt, or Russia that fears a deep recession. This risk can be represented by sovereign bond spreads, that abruptly rise when financial markets fear a sovereign default.
This article examines the effects of oil and gas reserves on those sovereign spreads in emerging oil and gas countries, and investigates whetheher financial markets view differently oil and gas. According to the U.S Energy Information Administration, oil and gas proved reserves are defined as "quantities of oil and gas, which, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be economically producible from a given date forward, from known reservoirs, and under existing economic conditions, operating methods, and government regulations."

The literature mainly focuses on oil importing developped economies (usually the United States and European economies) or on emerging countries. Some papers have brought to the fore the determinants of sovereign spreads in emerging countries. For example, Hilscher and Nosbusch (2010) investigate the effects of macroeconomic fundamentals on emerging market sovereign credit spreads. Akitoby and Stratmann (2008) study the impact of fiscal policy on sovereign risk spreads, and the relation between political institutions and fiscal indicators. They show that the composition of fiscal policy matters. Indeed, revenue-based adjustments lower spreads more than spending-based adjustments, and cuts in current spending decrease spreads more than cuts in investment. One strand of the literature focuses more precisely on oil, level of debt, and risk of default through sovereign spreads. Kretzmann and Nooruddin (2005) examine the relationship between oil and debt and find that increasing oil production is associated with increasing debt. Van der Ploeg and Venable (2010) study optimal policies for resource-rich developing countries, which often face high domestic interest rate. They provide empirical evidence on the interest rate those economies have to pay, and find that the ratio of resource exports to GDP is not statistically significant. Moreover, some authors have empazised the role

of the oil price in the risk of default. Sharma and Thuraisamy (2013) find that oil price uncertainty predicts the change in Credit Deafult Swaps (CDS) spreads of some Asian countries. Alexandre and Benoist (2011) show that oil prices influence the government bond risk premium, and that an increase in oil prices is expected to decrease the CDS spreads of emerging markets. Another brand of the literature emphazises on natural resource wealth and institutional variables, and more precisely on oil and conflicts (Ross, 2006), and corruption.

I fill the gap by studying empirically the relation between sovereign spreads and oil and gas reserves, through a panel of ten emerging oil and gas exporting countries between 1994 and 2014. The article contributes to the empirical literature by introducing oil and gas reserves as determinants of sovereign spreads. The literature usually focuses mainly on macroeconomic and financial variables, at the local and global level, but does not take into account geological variables. The other contribution is to study different natural resources, like gas, and not just examine oil itself as many articles do. I then introduce some institutional variables in the model, such as corruption, political stability, democracy in order to investigate whether the interaction between oil, gas reserves and institutional quality can affect spreads.

The main results of this study are:
- oil reserves increase spreads whereas gas reserves lower spreads,
- the effect of oil reserves on spreads depends more on the institutional quality of the country than gas reserves.

In fact, oil reserves increase spreads when the level of corruption and political risks are high, but lower spreads in political stable and not corrupt countries. Gas reserves decrease spreads, whatever the institutional quality of the country is.

The paper is organized as follows. Section 2 presents some stylized facts and the theoretical background. Section 3 discusses the econometric framework. Section 4 reports the empirical findings.

2 Stylized facts and theoretical framework

2.1 Some stylized facts

2.1.1 History of default in emerging oil countries

Among recent defaults by Mexico (1982), Russia (1998), Ecuador (1999) and Argentina (2001, 2014), and the current debt crises of Greece, it is worth to underline that many of them are oil and gas exporting countries. Surprisingly, their level of debt was not that high. In fact, Mexico's 1982 debt crisis occurred at a ratio of debt to GNP of 47 percent, and Argentinas 2001 crisis at a ratio slightly above 50 percent. Thus, oil and gas reserves do not seem to prevent from sovereign risk, but it will be interesting to see how those reserves can in fact be viewed by financial markets, when oil and gaz exporting countries issue their debts.

On average the maturity of sovereign oil countries'debt is a long-term debt, usually issued in US dollar. Mainly Paris Club Members (such as France, UK, USA, Germany Japan), and also multilateral creditors hold those sovereign debts.

2.2 Theoretical background

The framework refers to Edwards' model (1984, 1986). It is assumed that lenders are risk-neutral. The equilibrium condition is:

$$(1 - r^*) = pB + (1 - p)(1 + r)$$

with r^* the worl interest rate, p the probability of default, r the lending rate and B the amount paid by the borrower in default to the lender.

From this condition, the country's risk represented by the spread s is given by:

$$s = \frac{p(1 + r^* - B)}{1 - p}$$

Following the litterature on sovereign risk theory, the probability of default can be expressed as:

$$p = \frac{exp(\sum_{i=1}^{n} \mu_i W_i)}{1 + exp(\sum_{i=1}^{n} \mu_i W_i)}$$

with W_i the determinants of the probability of default.

By using the previous equations, and transforming it with a logarithmic function, it leads to:

$$logs = logj + \sum_{i=1}^{n} \mu_i W_i + \epsilon_i$$

with ϵ_i the random disturbance.

3 The empirical specification

I investigate whether oil and gas reserves have an impact on sovereign spreads, and if they are viewed the same way by financial markets.

3.1 The variables

As there are many macroeconomic determinants of spreads in the literature, we took the same control variables as Akitoby and Stratmann (2008), which are the variables the more widely used in the literature: the ratio of external debt to Growth National Income (GNI), the history of default, the regional spread index, the ratio of foreign exchange reserves to Growth Domestic Product (GDP), inflation (Consumer Price Index), and the output gap. External debt

is a fundamental determinant of sovereign spread, and it is expected to have a positive sign. The history of default is a dummy variable, which reveals if the country is in default or not for the year studied. As Reinhart and Rogoff (2009) emphazise, Venezuela can be seen as a "modern-day sovereign default champion" as it has defaulted 10 times since 1830. The regional spread index gives a good idea of the risk of contagion in the region, as usually those countries have tight lies with their commercial neighbours. For example, the Argentinian 2001 crisis had an impact on the Brazilian economy. Foreign exchange reserves is also a major determinant of spreads, as is represents the capacity of a country to pay back its debt, it should have a negative sign and thus lower spreads. Oil and gas countries usually accumulate huge amounts of foreign reserves. Inflation reveals the macroeconomic stability of the economy, so if inflation is low it shoud be positively vewed by financial markets. Output gap gives more information than the economic growth, as it takes into account potential growth.

Oil and gas reserves, which are considered as stocks and represent natural resource wealth, are added to those variables. Production and exports variables, which are seen as flows, are also taken into account.

3.2 Testing the impact of oil and gas reserves on spreads

The following formulation is used for the baseline model:

$$Logspread = \alpha_i + \delta debt_{it} + \sum \beta' C_{it} + \gamma_1 OilReserve_{it} + \gamma_2 GasReserve_{it} + \mu_t + \epsilon_{it} \quad (1)$$

where $debt_{it}$ is the ratio of external debt to Gross National Income, C_{it} is a vector of control variables, $OilReserve_{it}$ is the proved oil reserves, $GasReserve_{it}$ the proved gas reserves, α_i a country fixed effect, μ_t the time fixed effect and ϵ_{it} are the error terms. I used as control variables the history of default, the regional spread index, the ratio of foreign exchange reserves to GDP, inflation, and the output gap.

3.3 Testing the interactions between oil and gas reserves and institutional quality

The specification for testing the interactions between oil and gas reserves and corruption is:

$$Logspread = \alpha_i + \delta debt_{it} + \sum \beta' C_{it} + \sum \gamma' R_{it} + \lambda Instit_{it} + \sum \phi (R_{it} Instit_{it}) + \mu_t + \epsilon_{it} \quad (2)$$

where $Instit_{it}$ represents institutional variables, such as the level of corruption, political stability, democracy; R_{it} stands for oil and gas reserves, $R_{it}Instit_{it}$ is the interaction between oil and gas reserves and those institutional variables.

4 Data and Results

4.1 The data

The analysis is based upon data recorded at an annual frequency, over the 1994 2014 period, in 10 emerging oil countries: Algeria, Argentina, Brazil, Ecuador, Mexico, Venezuela, Indonesia, Malaysia, Russia, and Nigeria.

The dependent variable is the annual mean spread, which is obtained from the JP Morgan Emerging Markets Bond Index Global (EMBI Global). This index includes U.S. dollar denominated Brady bonds, Eurobonds, traded loans, and local market debt instruments issued by sovereign and quasi-sovereign entities. It considers only emerging markets issues over US dollar 500 million and with a maturity of at least two years and a half. The measures of financial variables are extracted from the Datastream.

Macroeconomic variables are obtained from the World Bank indicator and the International Monetary Fund. Institutional variables are from the World Bank Governance Index.

Oil and gas reserves come from the US Energy Information Agency (EIA). Oil reserves are crude oil proved reserves in billion barrels, and gas reserves are in billion metric tons. The oil price is represented by the West Texas Intermediate (WTI) and expressed in dollars. The gas price is from a natural gas futures contract in dollars per million British thermal units (Btu).

4.2 Results

4.2.1 Impact on spreads

As shown in Table 2, some of the control variables, as the debt to GNI ratio, regional spread, the foreign exchange reserves to GDP ratio, are all significant and have the expected sign. The ratio of the foreign exchange reserves to GDP is negative, as it enables a country to service its debt and thus decreases the risk of default. The coefficients of the debt to GNI ratio, regional spread, and the history of default are on the contrary positive. Nevertheless, the output gap and inflation are not significant.

Oil reserves and gas reserves are significant, but have opposite signs. Oil variables tend to increase spreads, therefore financial markets penalize oil countries, whereas gas reserves tend to decrease spreads, as if markets give a premium to countries detaining gas. Those results could be explained by the fact that oil is seen as volatile, sold on spot markets, at short-term and at a global price. Volatility hampers economic growth, and a sudden fall of oil price can stop confortable revenues and jeopardize public investments. On the contrary, gas is traded in the form of long-term supply contracts, and often through bilateral relations, which ensure the producing country a steady flow of revenues. It also secures the high capital investment necessary to develop and transport gas. For financial markets, gas reserves would thus mean more stability, and less volatility. The oil price appears to be significant at the 1% level, and have a negative sign. This is in line with the results in the oil price literature. Indeed,

the more oil prices increase, the more oil revenues grow, which lowers spreads. Nevertheless, the gas price is not significant.

The impact of oil exports, oil production, gas exports, gas production on spreads were also tested, but they all appear to be not significant. As they are flows, high natural resource production and export represent current wealth. But those current revenues could vanish rapidly if the country has no natural resource reserves, which embody future wealth. This could explain why they are not taken into account by financial markets. Oil and gas rents were also used as explanatory variables. Expressed as a ratio of the GDP, those rents come from the World Banks Adjusted Saving Project, defined as the difference between the value of crude oil/gas production at world prices and total costs of production. As for production and export variables, they were insignificant. A country with important oil and gas rents, but with no major oil and gas reserves is bound to see its revenues decrease (especially for not diversified economies), and thus face more difficulty to pay its debt in the future. Therefore, financial markets value more the future, represented by the oil and gas reserves, than the present.

4.2.2 Interactions between oil and gas variables and institutional quality

The introduction of institutional variables in the model is justified by the literature on oil and institutions. Studies on natural resource and conflict show that natural resources are associated with social tensions (Auty and Gelb, 2001), and that oil production often leads to civil war (Collier and Hoeffler, 2002, Ross, 2006). A negative correlation between natural resources and the level of democracy in Africa has been brought to the fore by Jensen and Wantchekon (2004). Moreover, oil extraction is usually associated with more corruption (Bhattacharyya and Hodler, 2009). I thus added in the regression a variable standing for corruption, measured by the Transparency International Corruption Perception Index, that scores between 1 for high corruption and 10 for not corrupt countries. I kept the same control variables, to see the impact of the interaction between oil reserves and corruption, with the level of corruption itself, on spread. The coefficient of oil reserves continues to be significant and positive. The estimate of the interaction term between oil reserves and corruption is negative. The less a country is corrupted, the more the spread decreases. Therefore, when oil reserves increase, the spread increases for countries plagued by sleaze, whereas the spread lowers for not corrupt countries. Concerning gas reserves, the coefficient is still negative, but is no longer significant. As it can be seen on figure 2, spreads decrease for corrupt and not corrupt countries. Neverheless, spreads lower faster for not corrupt countries. Therefore financial markets do not seem to take into account corruption concerning gas reserves, contrary to oil. This confirms my results that oil and gas reserves affect differently financial markets.

As democracy and oil wealth are usually linked (Tsui, 2011, Arezki and Bruckner, 2012), a dummy standing for democracy was added to examine the

impact of an interaction between democracy and oil, gas reserves, but the coefficient appear not to be significant. The occurence of legislative and executive elections did not change my results either. I also introduced an interaction with political stability, governement effectiveness, rule of law, regulatory quality (that come from the Worldwide Governance Indicators project supported by the World Bank) and political, civil rights (that are from Freedom of House). For most of those variables, the estimates are insignificant and thus not reported. It is interesting though to highlight that regulatory quality has a significant impact on spreads, but oil and gas reserves are no longer significant. Nevertheless, when I interact oil and gas reserves with political stability the results show that the impact of those reserves on spreads differ whether the country is affected by conflicts or not. The political stability index scores from -2,5 when the country is plagued by violent activities to 2,5 when it is stable. Oil and gas reserves remain significant, with the same sign, but when the country is politically unstable spreads increase more.

4.3 Robustness checks

Different sensitivity checks were performed. A range of econometric methods was used and the results were still significant with Ordinary Least Squares (OLS) and random effects. I also checked for stationarity with the Augmented Dickey Fuller (ADF) test. All my variables were stationary, except oil price, so the first difference of oil price was used.

The occurence of a currency crisis did not affect my results. Alternative measures of solvency were used, which gave similar results. I also tested the impact of being an OPEC (Organization of Petroleum Exporting Countries) member, as OPEC members represent 75 % of the world's total proven crude reserves. This estimate is not statistically significant, while the results on the oil and gas variables still hold. Moreover, removing large producers of both oil and gas from the sample, like Algeria or Russia, increases the impact of oil and gas reserves on sovereign spreads. Their estimates remain significant and keep the same sign.

I also used lagged variables. The lagged value of the dependent variable was significant at the 1 percent level. My results were still significant when we used a Generalized Method of Moments (GMM) estimation.

5 Conclusion

In this paper, I examined the impact of oil and gas variables on sovereign spreads, using annual panel data in ten emerging oil ans gas exporting countries. My contribution is to take into account the impact of gas, unlike many papers dealing with natural resources that only focus on oil. It enables me to see if financial markets view the same way different natural resources. I then introduced some institutional variables in the model, such as corruption, political stability, democracy in order to investigate whether the interaction between oil, gas reserves and institutional quality can have an impact on sovereign risk.

The evidence suggests that financial markets view differently oil and gas. Indeed, I find that financial markets give a premium to gas reserves, that lower spreads, and penalize on the contrary oil reserves, that increase them. One interpretation is that gas tends to ensure constant revenues thanks to its long-term supply contracts, usually through bilateral relations, at a regional level. On the contrary, oil is much more exposed to volatility as it is traded at short-term on spots markets at a global level. Moreover, oil is seen as more prone to conflicts, corruption and political unrest. I thus interact those reserves with institutional variables. I show that political stability and corruption affect sovereign spreads when they interact with oil reserves. Indeed, oil reserves increase spreads when the country is corrupt and political unstable, but lower spreads for not corrupt country with a stable government. By contrast, whatever the institutional quality is, gas reserves decrease spreads, even when the level of corruption and political risks are high.

Those results suggest policy implications for those economies. First, oil and gas countries should try to reduce gas flaring. Indeed, those countries usually burn off the gas that is produced along with oil, as gas is much more costly in terms of infrastructures and transport than oil. Taking actions to end flaring would reduce their CO2 emissions and represent a good opportunity to trade their gas, even though it is a costly investment. It would nevertheless be worth it as they could secure other source of revenues than just oil throuh long-term supply contracts. As my empirical results show, having gas reserves has the advantage of lowering sovereign spreads, which means lowering their borrowing cost on international capital markets, and thus let the government be able to invest in productive areas of the economy, fostering economic growth. Those countries with major gas reserves should value more the importance of this natural resource and the advantages that come with it. Second, countries that hold mainly oil reserves should try to fight more firmly against corruption and take actions to end conflicts, as institutional quality is the key for decreasing spreads.

Further research could also include data on oil discoveries to see if major discoveries, synonymous of future wealth, could confirm our results.

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Table 1: Descriptive Statistics

	Mean	Standard Deviation	Min	Max
Log of annual mean spread	6.308	0.908	3.237	8.664
External debt to gni	42.773	28.129	2.063	210.334
To be in default	0.220	0.415	0	1
Regional spread	458.275	261.959	133.391	2046.636
Foreign exghange reserves to gdp	19.224	19.742	1.221	113.045
Log inflation	2.317	1.083	-2.748	7.639
Log oil reserve	2.422	1.236	0.451	5.696
Log gas reserve	11.129	1.477	7.431	14.346

Table 2: Effect of Oil and Gas Reserves on Spreads
(Dependent variable: annual mean spread)

	Fixed Effects		
	(1)	(2)	(3)
External debt to gni	0.015***	0.017***	0.017***
	(0.003)	(0.002)	(0.002)
To be in default	0.408**	0.370*	0.370*
	(0.165)	(0.184)	(0.184)
Regional spread	0.001***	0.001**	0.001**
	(0.000)	(0.000)	(0.000)
Foreign exghange reserves to gdp	-0.040***	-0.032***	-0.032***
	(0.008)	(0.008)	(0.008)
Log inflation	0.038	0.117*	0.117*
	(0.074)	(0.056)	(0.056)
Log oil reserve		0.334***	0.334***
		(0.061)	(0.061)
Log gas reserve		-0.441***	-0.441***
		(0.130)	(0.130)
Oil price			-0.048***
			(0.005)
Constant	4.537***	8.257***	8.435***
	(0.222)	(1.350)	(1.341)
Observations	141	141	141
R^2	0.778	0.805	0.805

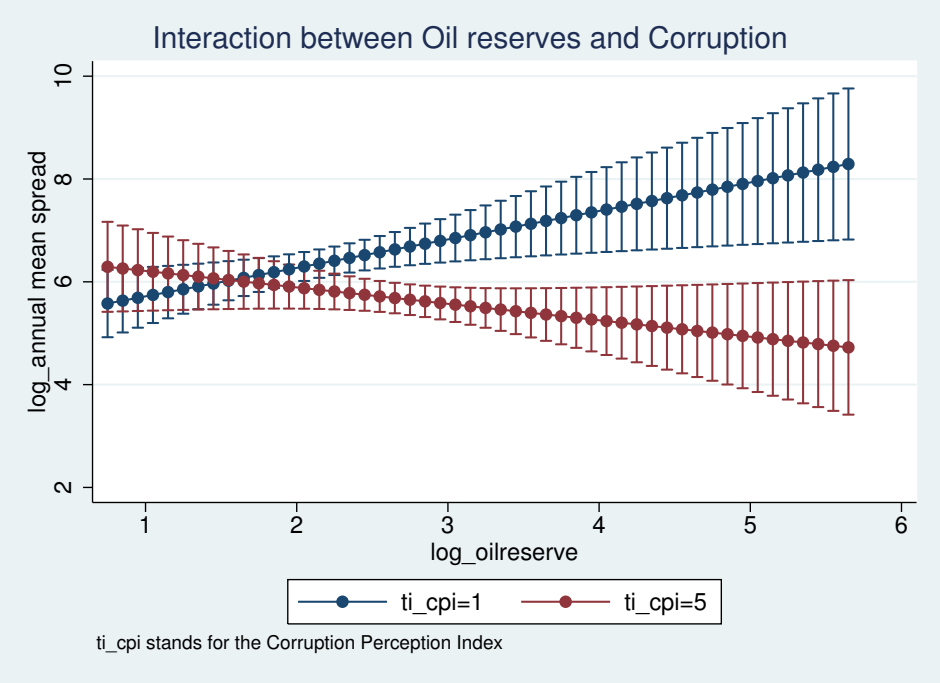
Robust standard errors are in parentheses. All columns include year and country fixed effects.
The list of the 10 countries included in the sample is as follows: Algeria, Argentina, Brazil Ecuador, Indonesia, Malaysia, Mexico, Nigeria, Russia, and Venezuela
The time period is 1994-2014.
Statistical significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Effect of Oil and Gas Reserves on Spreads, with Interaction with Institutional quality (Dependent variable: annual mean spread)

	Corruption	Political Stability	Democracy
External debt to gni	0.014***	0.012***	0.016***
	(0.003)	(0.004)	(0.003)
To be in default	0.374	0.555**	0.337
	(0.231)	(0.213)	(0.231)
Regional spread	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
Foreign exghange reserves to gdp	-0.023**	-0.027**	-0.023**
	(0.010)	(0.011)	(0.008)
Log inflation	0.078*	0.115*	0.107**
	(0.035)	(0.057)	(0.042)
Log oil reserve	0.877***	0.372***	0.376***
	(0.188)	(0.097)	(0.071)
Log gas reserve	-0.574***	-0.273**	-0.549
	(0.174)	(0.103)	(0.373)
Corruption	-0.009		
	(0.544)		
Log oil reserve × Corruption	-0.172**		
	(0.069)		
Log gas reserve × Corruption	0.024		
	(0.063)		
Political Stability		-3.831***	
		(1.167)	
Log oil reserve × Political Stability		-0.213	
		(0.216)	
Log gas reserve × Political Stability		0.377**	
		(0.141)	
Democracy			-0.779
			(3.333)
Log oil reserve × Democracy			0.081
			(0.131)
Log gas reserve × Democracy			0.072
			(0.321)
Constant	9.909***	7.373***	10.249**
	(1.370)	(1.085)	(4.267)
Observations	136	113	141
R^2	0.704	0.712	0.696

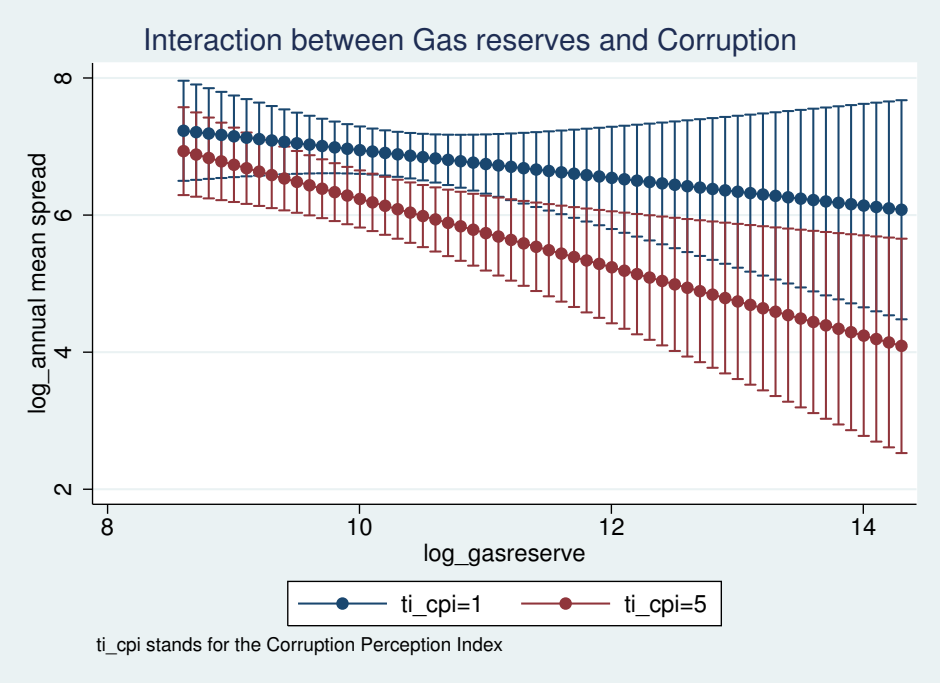
Robust standard errors are in parentheses. All columns include year and country fixed effects. The list of the 10 countries included in the sample is as follows: Algeria, Argentina, Brazil, Ecuador Indonesia, Malaysia, Mexico, Nigeria, Russia, and Venezuela. The time period is 1994-2014. Statistical significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 1: Impact of oil reserves on spread depending on the level of corruption



When $ti\_cpi = 1$ the level of corruption is high, when $ti\_cpi = 5$ the level of corruption is low.

Figure 2: Impact of gas reserves on spread depending on the level of corruption



When $ti\_cpi = 1$ the level of corruption is high, when $ti\_cpi = 5$ the level of corruption is low.